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***THE ARRANGEMENT OF THE MUSCULAR LAYERS OF  
THE INTESTINE OF THE CAT IN THE REGION  
OF THE JUNCTURE OF THE LARGE  
AND SMALL INTESTINES.***

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ROBERT ORTON MOODY, B. S.

Instructor in Histology, Yale Medical College.

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In the determination of the arrangement of these muscular coats in the cat two methods were used, viz., dissection and microscopic examination of serial sections. I have traced the fibres in ten cæcums prepared by maceration, made one series of longisections through the right lateral aspect of the juncture of the large and small intestines, and one series of transections through the small intestine and cæcum.

To obtain the outline of the drawings of microscopic sections an "Abbe camera lucida" and a three-inch objective were used. The details were studied with a three-fourths and higher objectives and drawn free hand. In both series of microscopic sections the ectal serous coat was ignored in making the drawings.

On account of the great variation in the arrangement of the muscular coats and the small number of cæcums examined, I have been unable to determine the prevailing typical arrangement, but I have determined two extremes between which all other arrangements may be found and have noted some peculiar and interesting relations of these coats.

Thanks are due to Prof. B. G. Wilder, of Cornell University, for assistance in obtaining material and suggestions as to books of reference, and to Prof. Simon H. Gage, of Cornell University, for direction as to methods of work and for help in many other ways.

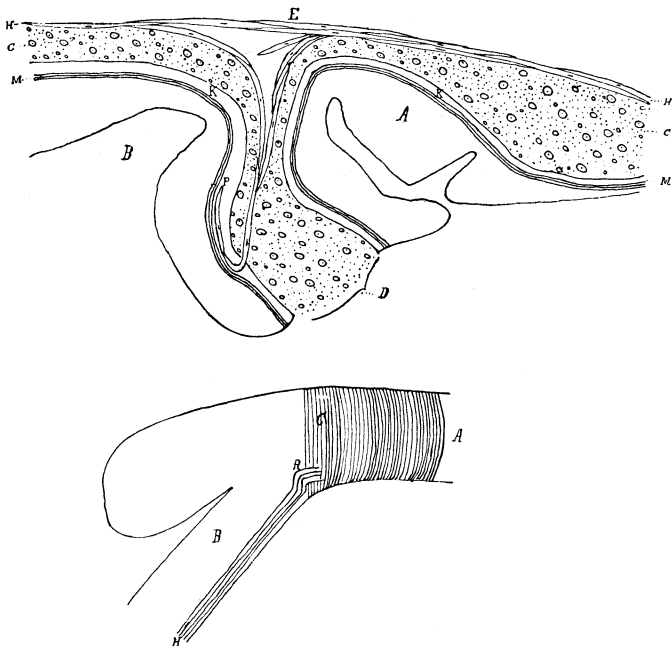
The muscular coat of the intestine of the cat consists of two superimposed layers, viz., an ectal, longitudinal, and ental circular layer, distinguished by the direction of the fibres. The fibres of the longitudinal layer are parallel with the long axis of the intestine. Those

of the circular layer embrace the intestine with circular coils at right angles to the long axis.

At and near the juncture of the colon and the small intestine, where the muscular layers of the two intestines meet, their arrangement becomes most complex and varied.

Verson says, in his article on the small intestine, in Stricker's Manual of Histology, page 381: "In the cat the longitudinal fibrous layer does not enter into the formation of the valve—ileo-

PLATE I.



Upper figure—FIG. 1.

Lower figure—FIG. 2.

cæcal—but usually, like the peritoneum, extends uninterruptedly over it." By this I understand him to mean that the longitudinal fibres of the small intestine usually pass uninterruptedly on to the large intestine, which is not as I have found it to be.

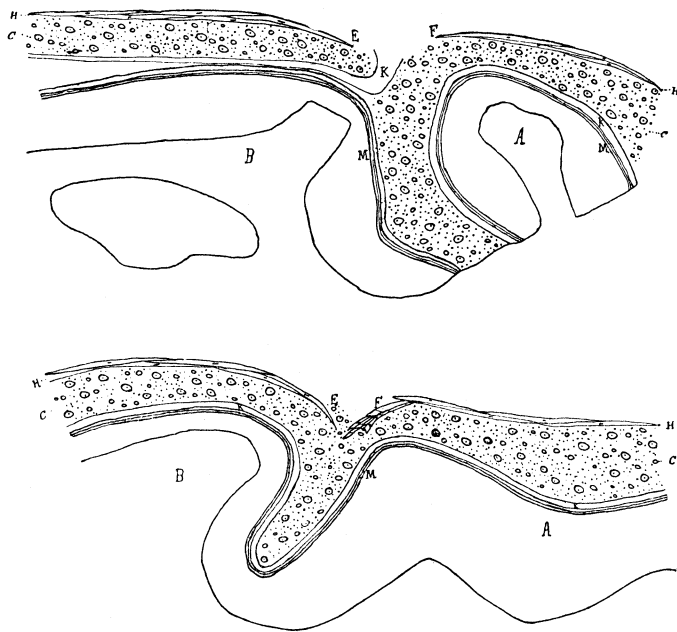
The arrangement of the fibres differs not only on different intestines, but also on different aspects of the same intestine.

On the left lateral aspect of the ileum and colon in this region I have found the following arrangements:

(a) All, or nearly all, of the longitudinal fibres on this aspect of the small intestine pass uninterruptedly to the left lateral aspect of the colon, and are continuous with the longitudinal fibres of the colon.

(b) All the longitudinal fibres on this aspect of the small intestine, at the line of juncture of the two intestines, turn inward and pass under the circular layer of the large intestine and terminate in the sub-mucosa of the colon (Plate I, Fig. 2, R). In this case the

PLATE II.



Upper figure—FIG. 1.

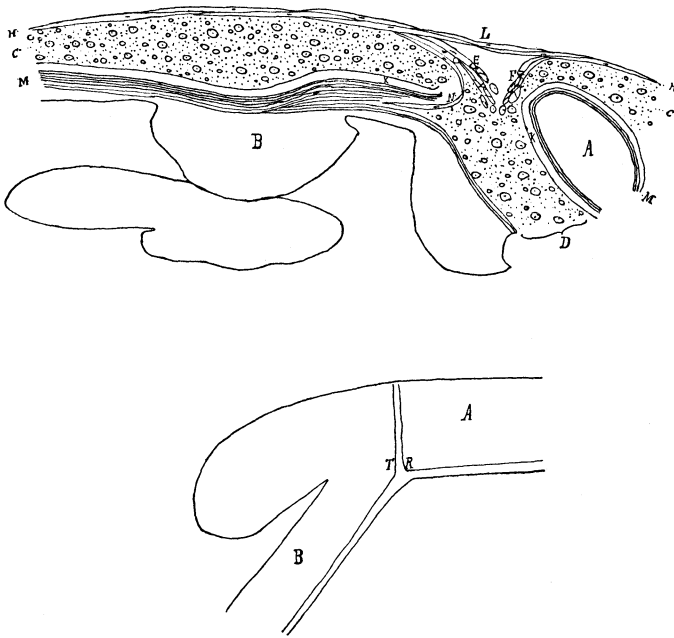
Lower figure—FIG. 2.

longitudinal layer of the colon becomes thin as it approaches the juncture, and terminates as a very thin layer on the large intestine, or turns and ends in the sub-mucous coat, or forms a combination of these two.

(c) Part of the fibres on this aspect of the small intestine pass uninterruptedly to the large intestine, becoming continuous with the longitudinal layer on the left lateral aspect of the colon (Plate I, Fig. 1, E); part turn inward and are lost in the circular layer

(Plate II, Fig. 2, E); part turn inward, pass through the circular layer, and end in the sub-mucosa (Plate I, Fig. 1, P; Fig. 2, R); part turn and become circular fibres on the large intestine (Plate III, Fig. 1, E; Fig. 2, T), and part turn inward, pass through the circular layer and the sub-mucous coat, and become continuous with the fibres of the muscularis mucosæ (Plate III, Fig. 1, N); part run out on the small intestine and do not pass to the large intestine (Plate II, Fig. 1, E).

## PLATE III.



Upper figure—FIG. 1.

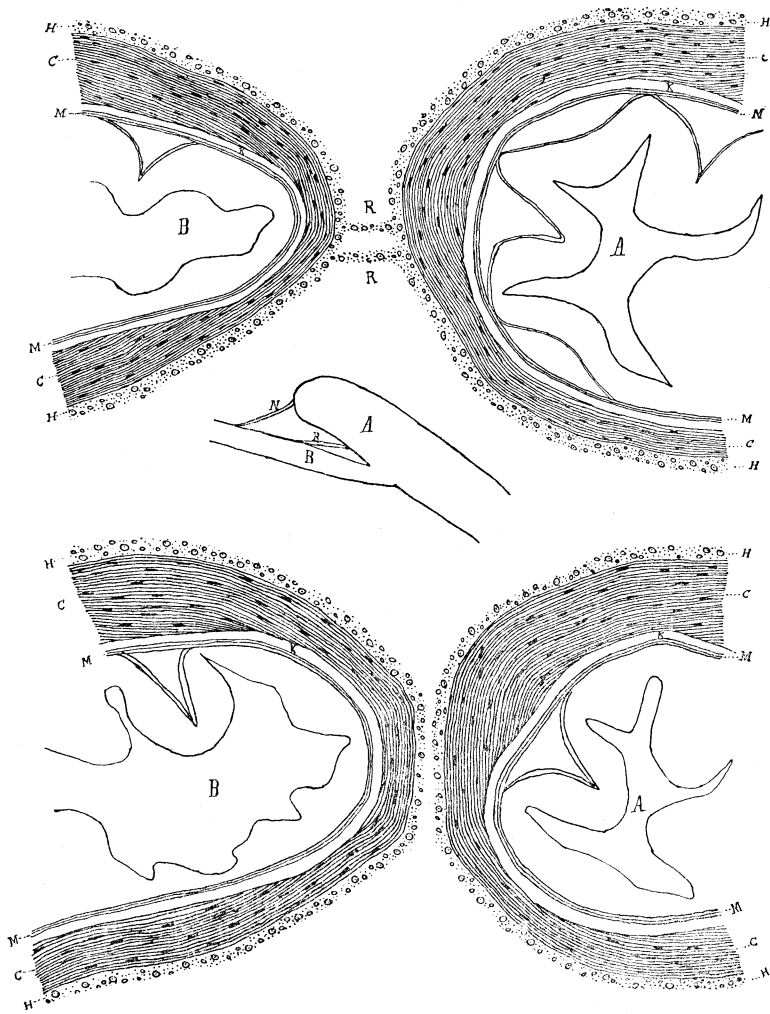
Lower figure—FIG. 2.

In this case part of the longitudinal fibres of the left lateral aspect of the colon are continuous with those of the small intestine (Plate III, Fig. 1, L), and part turn, as do those of the small intestine, becoming lost in the circular layer (Plate II, Fig. 2, F); part become circular fibres on the large intestine (Plate III, Fig. 1, F; Fig. 2, R), and part run out on the large intestine (Plate II, Fig. 1 F).

(d) The longitudinal fibres of this aspect of the small intestine and the left lateral aspect of the colon, at the point of juncture of

the two intestines turn in, part becoming lost in the circular layer and part terminating in the sub-mucosa.

## PLATE IV.



Upper figure—FIG. 1. Middle figure—FIG. 2. Lower figure—FIG. 3.

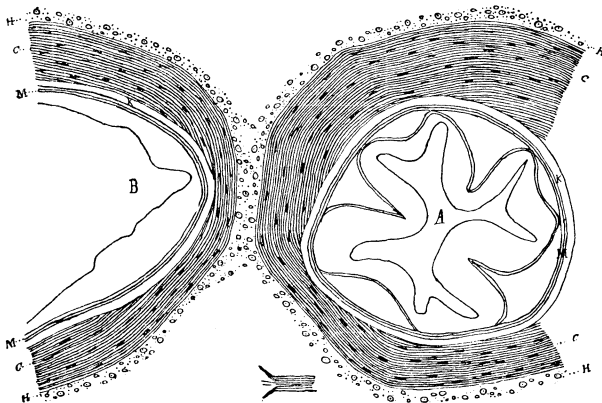
On the dorsal and ventral aspects the arrangement of the longitudinal muscular layers is sometimes similar to that on the left lateral aspect, but in some cases I found it so complex that I could not

form any idea of the arrangement. In one case longitudinal fibres on the dorsal aspect of the small intestine passed across the left lateral aspect of the small intestine near the line of juncture as circular fibres, and, turning, passed up on the ventral aspect as longitudinal fibres, thus forming the letter U.

The arrangement of the fibres in the region of the juncture of the right lateral aspect of the ileum and the left lateral aspect of the cæcum is also somewhat complex, but quite different from that in the region of the juncture of the left lateral aspect of the ileum and the colon.

Transections show that at about the middle of the left lateral aspect of the cæcum longitudinal fibres pass through the fat and

PLATE V.



Upper figure—FIG. 1.

Lower figure—FIG. 2.

connective tissue, which usually lie between the ileum and the cæcum in this region, from the cæcum to the ileum (Plate IV, Figs. 1 and 2, R).

That there is not a continuous muscular connection throughout the length of this aspect is shown by a transection made nearer the point of juncture, which shows the longitudinal layers of the cæcum and ileum entirely separate, without connection of any kind (Plate IV, Fig. 3).

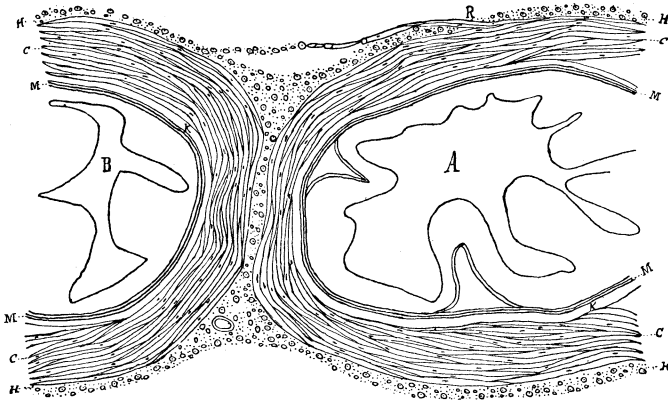
This passage of the longitudinal fibres from the cæcum to the ileum, in this vicinity, was demonstrated on another subject by dissection.

The transection still nearer the point of juncture shows the longi-

tudinal layer on this aspect of the ileum becoming very thin and mingling with the thickened longitudinal layer on the cæcum, so that the two longitudinal layers cannot be distinguished (Plate V, Fig. 1).

About seven millimeters from the line of juncture of this aspect of the small intestine with the cæcum the longitudinal fibres of the ileum enter into one of two muscular pillars, in which the direction of the fibres is diagonal to the long axis of the intestine. (Plate V, Fig. 2). In some cæcums not all the longitudinal fibers enter into these pillars, but a few continue over the circular layer of the ileum

PLATE VI.



a few millimeters, and run out, or else turn in, to be lost in the circular layer. The fibres that pass into the pillars terminate mostly on the sub-mucosa of the large intestine, but sometimes part of them become circular fibres on the small, and others circular fibres on the large intestine.

On one specimen, longitudinal fibres were found to pass from the apex of the cæcum to the right lateral aspect of the ileum and to become continuous with the longitudinal layer on that aspect of the small intestine (Plate IV, Fig. 2, N).

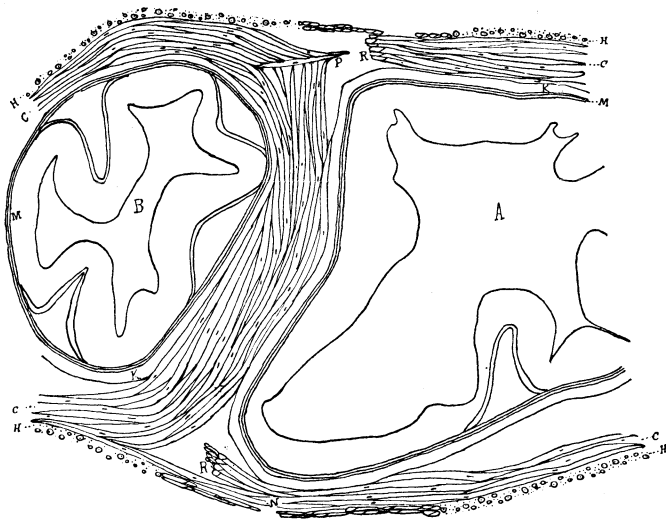
The variations and complications which I have determined in the arrangement of the circular layers in the region of the juncture of the two intestines are as follows :

(a) Some of the muscular fibres on the dorsal aspect of the cæcum pass through the longitudinal layer of the cæcum, thus becoming external to it, and become continuous with the longitudinal muscular layer on the dorsal aspect of the ileum (Plate VI, R).



(b) The circular layer of the cæcum runs out on the ventral and dorsal aspects (Plate VII, R), and is wanting on all the left lateral aspects of the cæcum where the circular layer of the ileum is in contact with the sub-mucous coat of the cæcum. Some of the circular fibres on the dorsal and right lateral aspects of the small intestine turn from the main body of the circular layer and project toward the circular layer on the dorsal aspect of the cæcum (Plate VII, P), while on the ventral aspect some of the circular fibres pass uninterruptedly from one intestine to the other (Plate VII, N).

PLATE VII.



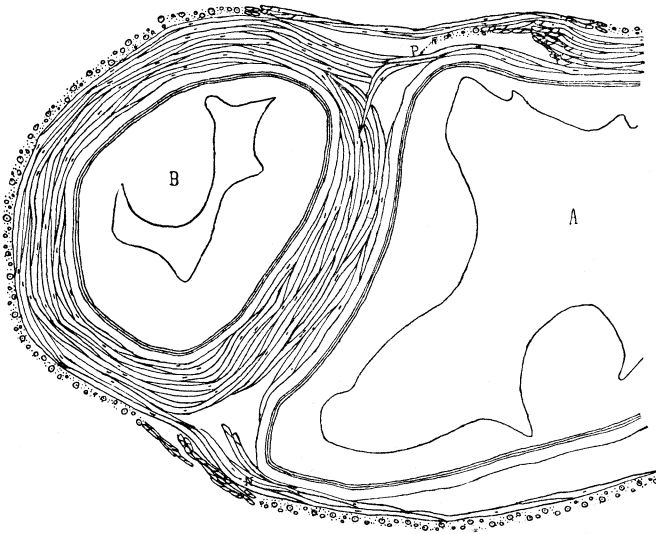
(c) Still nearer the juncture of the two intestines, where the circular layer of the cæcum runs out on the dorsal and ventral aspects, the external portion of the circular layer, before it runs out, turns so that its fibres instead of being cut parallel are cut at right angles (Plate VIII, R). The deeper portion of the circular layer on the dorsal surface becomes continuous with the fibres from the dorsal and right lateral aspect of the small intestine (Plate VIII, P). On the ventral surface, part of the circular fibres of the two intestines are continuous (Plate VIII, N).

(d) On one specimen, fibres of the circular layer near the juncture of the two intestines pass, with the two muscular pillars of longitudinal fibres mentioned in connection with the arrangement of the

longitudinal fibres on the right lateral aspect of the small intestine, on to this aspect of the small intestine, and, turning inward, become lost in the circular layer or terminate in the sub-mucosa at different distances from the line of juncture of the two intestines.

If it were desirable, many other variations of the arrangement of the muscular layers in the cæcal region of the intestine of the cat might be given, but enough have been given to establish the fact that the most common typical arrangement has not yet been determined, and that further investigation along this line is needed.

PLATE VIII.



If, as a result of my work, I tried to make any classification of the arrangement of these muscular layers, I should say that there were two extremes, viz., where all or nearly all of the longitudinal fibres on the dorsal, ventral, and left lateral aspects pass uninterruptedly from one intestine to the other, and where all or nearly all of the longitudinal fibers do not pass from one intestine to the other, but turn inward and become continuous with the circular layer, or are lost in the circular layer, or end in the sub-mucosa, and that between these two extremes are innumerable variations.

In connection with my work on the cat, I have searched carefully to find what has been done in regard to the determination of the arrangement of these muscular layers in man.

Henle and Verson, the only two authors who seem to have done any original work on this line, differ considerably in their conclusions.

Verson, in his article on the Small Intestine, in Stricker's Manual of Histology, page 381, says: "In its further course the muscular tube presents nothing remarkable until it reaches the valvuli coli. Throughout this, as is particularly observable in the new-born child, only the circular layer passes, while the longitudinal layer is interrupted; and, indeed, the bands of the latter, proceeding on the one hand from the ileum and on the other from the colon, become considerably attenuated toward the free border of the valve, while many muscular fasciculi interlace with each other, and, finally, as my preparations show, arch toward the adjoining circular layer."

Henle, page 194, says: "While the circular layer of the small intestine passes over into the valvuli coli the longitudinal fibres project themselves in large passing-over bundles; part in elastic tendons into the whole circumference of the point of insertion on the side of the large intestine, part losing themselves between and part upon the circular fibres."

Allen says, page 653: "The longitudinal coat of the ileum is continuous with that of the cæcum."

Which of these views is correct I do not know. Is it not possible that in man, as in the cat, the arrangement of these layers is complex, and that both Verson and Henle are partially correct?

#### *Description of Plates.*

#### PLATE I.

*Longisection of the left lateral aspect of the ileum and large intestine.*

#### FIGURE 1.

- A—Large intestine.
- B—Ileum.
- C—Circular muscular layer.
- D—Section incomplete.
- E—Longitudinal fibres passing uninterruptedly from one intestine to the other.
- H—Longitudinal muscular layer.
- K—Sub mucosa.
- M—Muscularis mucosæ.
- P—Longitudinal fibres of ileum terminating in sub-mucosa.

## FIGURE 2.

A, B, and C—Same as Fig. 1.

R—Longitudinal fibres of ileum terminating in sub-mucosa.

## PLATE II.

*Longisections through the left lateral aspect of the ileum and colon.*

## FIGURE 1.

A—Colon.

B—Ileum.

C—Circular muscular layer.

E—Longitudinal muscle layer of ileum running out on ileum.

F—Longitudinal muscle layer of colon running out on colon.

H—Longitudinal muscular layer.

K—Sub-mucosa.

M—Muscularis mucosæ.

## FIGURE 2.

Lettering the same as Fig. 1, except—

E—Longitudinal fibres of ileum terminating in the circular layer.

F—Longitudinal fibres of colon turn so as to be cut obliquely and terminate in circular layer.

## PLATE III.

*Longisection through the left lateral aspect of the ileum and colon.*

## FIGURE 1.

A—Colon.

B—Ileum.

C—Circular muscular layer.

D—Section incomplete.

E—Longitudinal fibres of ileum becoming circular fibres of colon.

F—Longitudinal fibres of colon becoming circular fibres of colon.

H—Longitudinal muscular layer.

K—Sub-mucosa.

L—Longitudinal fibres pass uninterruptedly from one intestine to the other.

M—Muscularis mucosæ.

N—Longitudinal fibres of ileum become continuous with the muscularis mucosæ.

## FIGURE 2.

A—Colon.

B—Ileum.

R—Longitudinal fibres of colon becoming circular fibres of colon, as shown by dissection.

T—Longitudinal fibres of ileum becoming longitudinal fibres of colon as shown by dissection.

## PLATE IV.

*Transection through the cæcum and ileum.*

## FIGURE 1.

A—Cæcum.

B—Ileum.

C—Circular muscular layer.

H—Longitudinal muscular layer.

K—Sub-mucosa.

M—Muscularis mucosæ.

R—Longitudinal muscular fibres passing from the left lateral aspect of cæcum to the right lateral aspect of the ileum.

## FIGURE 2.

A—Cæcum.

B—Ileum.

R—Shows the same as R in Fig. 1.

N—Shows longitudinal muscular fibres passing from the apex of the cæcum to the right lateral aspect of the ileum.

## FIGURE 3.

Transection of the cæcum and ileum nearer the point of juncture of the two intestines than the transection shown in Fig. 1. Lettered the same as Fig. 1. It shows the longitudinal layers of the ileum and cæcum entirely separate, having no connection with each other as in Fig. 1.

## PLATE V.

*Transection through the cæcum and ileum.*

## FIGURE 1.

A—Cæcum.

B—Ileum.

C—Circular muscular layer.

H—Longitudinal muscular layer.

K—Sub-mucosa.

M—Muscularis mucosæ.

Shows the fusion of the longitudinal muscular layers of the right lateral aspect of the ileum and the left lateral aspect of the cæcum.

## FIGURE 2.

Shows the separation of most of the longitudinal fibres on the right lateral aspect of the ileum into two pillars.

## PLATE VI.

*A transection through the cæcum and ileum.*

A—Cæcum.

B—Ileum.

C—Circular muscular layer.

H—Longitudinal muscular layer.

K—Sub-mucosa.

M—Muscularis mucosæ.

R—Circular fibres of cæcum passing through longitudinal fibres of cæcum and becoming longitudinal fibres of the ileum.

## PLATE VII.

*A transection through the cæcum and ileum.*

A—Cæcum.

B—Ileum.

C—Circular muscular layer.

H—Longitudinal muscular layer.

K—Sub-mucosa.

M—Muscularis mucosæ.

N—Circular fibres passing uninterruptedly from one intestine to the other.

P—Circular fibres on the dorsal and right lateral aspects of the ileum turn from the main body of the circular layer and project toward the circular layer of the cæcum.

R—The circular layer on the dorsal and ventral aspects of the cæcum runs out.

## PLATE VIII.

*A transection of the cæcum and ileum.*

A—Cæcum.

B—Ileum.

C—Circular muscular layer.

H—Longitudinal muscular layer.

K—Sub-mucosa.

M—Muscularis mucosæ.

N—Circular fibres passing uninterruptedly from one intestine to another.

P—Circular fibres from the dorsal surface of the cæcum becomes continuous with the circular fibres on the dorsal and right lateral aspects of the ileum.

R—Circular fibres on cæcum turn before running out, so that they are cut at right angles.